

Right brain

I am the right brain.
I am creativity. A free spirit. I am passion.
Yearning. Sensuality. I am the sound of roaring laughter.
I am taste. The feeling of sand beneath bare feet.
I am movement. Vivid colors.
I am the urge to paint on an empty canvas.
I am boundless imagination. Art. Poetry. I sense. I feel.
I am everything I wanted to be.

Pathology Team 431



CNS Block

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Pathogenesis and risk factors of cerebrovascular accidents

Objective

The student should:

- Explain the concepts of brain “Hypoxia”, “Ischemia” and “Infarction”.
- Understand the pathogenesis of thrombotic and embolic stroke and be able to identify clinical risk factors.
- Identify the causes and consequences of subarachnoid and intracerebral hemorrhage.
- Build a list of the different causes that can lead to cerebrovascular accident.

Introduction :

→ Review the following terms:

Hypoxia: is a pathological condition in which the body as a whole (generalized hypoxia) or a region of the body (tissue hypoxia), is reduction of oxygen supply to a tissue below physiological levels despite adequate perfusion of the tissue by blood. (There are 4 types)

Ischemia: is a restriction in blood supply to tissues, causing a shortage of oxygen and glucose needed for cellular metabolism.

Infarction: is a tissue death (necrosis) caused by an obstruction of the tissue's blood supply, which leads to a local lack of oxygen.

The brain may be deprived of oxygen by any of several mechanisms:

Functional Hypoxia:

- _ *Low partial pressure of oxygen (respiratory problem). E.g. sickle cell disease.*
- _ *Impaired oxygen-carrying capacity (like anemia). E.g. in carbon monoxide poisoning.*
- _ *Inhibition of oxygen use by tissue. E.g. Cyanide poisoning.*

Ischemia: either transient (can be recover and tissues did not die) or permanent (infraction) after interruption of the normal circulation flow.(tissues of brain died) ischemia happened if there is :

- a reduction in perfusion pressure, as in hypotension.
- vascular obstruction.
- both.

Cerebrovascular disease: is the third leading cause of death (after heart disease and cancer) in the United States

It is also the most prevalent neurologic disorder in terms of both morbidity and mortality

Morbidity: The rate of incidence of a disease.
Mortality: Death rate.

Stroke

It is the clinical term for a disease with acute onset of a neurologic deficit as the result of vascular lesions, either hemorrhage or loss of blood supply

	Thrombosis	Embolism
	Less common	More common
Sources	<p>The majority of thrombotic occlusions causing cerebral infarctions are due to <i>atherosclerosis</i>.</p> <p>Atherosclerotic stenosis can develop on top a superimposed thrombosis, accompanied by anterograde extension, fragmentation, and distal embolization</p>	<p>-Cardiac mural thrombi (frequent)</p> <ul style="list-style-type: none"> - myocardial infarct -valvular disease - atrial fibrillation <p>Arteries;(often atheromatous plaques within the carotid arteries) like our case in PBL</p> <ul style="list-style-type: none"> -Paradoxical emboli, particularly in children with cardiac anomalies(like in patent foramen ovale) -Emboli associated with cardiac surgery -Emboli of other material (tumor, fat, or air)
Most common site of :	<ul style="list-style-type: none"> -The carotid bifurcation -The origin of the middle cerebral artery -Either end of the basilar artery 	

why the middle cerebral artery is the one which can be easily occluded?

Because it is a direct continuation of the internal carotid artery.

Stroke

Clinical presentation:



- Depends on which part of the brain is injured, and how severely it is injured
- Sometimes people with stroke have a headache, but stroke can also be completely painless
- It is very important to recognize the warning signs of stroke and to get immediate medical attention if they occur
- If the brain damage sustained has been slight, there is usually complete recovery, but most survivors of stroke require extensive rehabilitation

Symptoms:

- 1) Sudden
- 2) The most common is weakness or paralysis of one side of the body with partial or complete loss of voluntary movement or sensation in a leg or arm
- 3) There can be speech problems and weak face muscles, causing drooling
- 4) Numbness or tingling is very common
- 5) A stroke involving the base of the brain can affect balance, vision, swallowing, breathing and even unconsciousness

In cases of severe brain damage there may be deep coma, paralysis of one side of the body, and loss of speech, followed by death or permanent neurological disturbances after recovery

Global Cerebral Ischemia:

- Widespread ischemic/hypoxic injury occurs when there is a generalized reduction of cerebral perfusion, usually below systolic pressures of less than 50mmHg
- Causes include:
 - cardiac arrest
 - severe hypotension or shock
- The clinical outcome varies with the severity of the insult
 - If mild → may be only a transient postischemic confusional state, with eventual complete recovery
 - In severe global cerebral ischemia, widespread neuronal death, irrespective of regional vulnerability, occurs

Neurons are much more sensitive to hypoxia than are glial cells

The most susceptible to ischemia of short duration are:

- 1- pyramidal cells of the sommer sector (CA1) of hippocampus
- 2- purkinje cells of cerebellum
- 3- pyramidal neurons in neocortex

Sommer Sector: is region CA1 of the hippocampus, a part of the human brain. It is one of the first brain regions to show gross changes in cerebral hypoxia.

persistent vegetative state:

Individuals who survive in this state often remain severely impaired neurologically and deeply comatose

respirator brain

Other patients meet the clinical criteria for "brain death," including evidence of diffuse cortical injury (isoelectric, or "flat," electroencephalogram) and brain stem damage, including absent reflexes and respiratory drive

When patients with this pervasive form of injury are maintained on mechanical ventilation, the brain gradually undergoes an autolytic process

Morphology of global ischemia

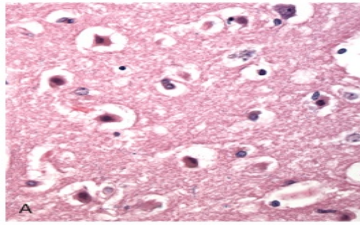
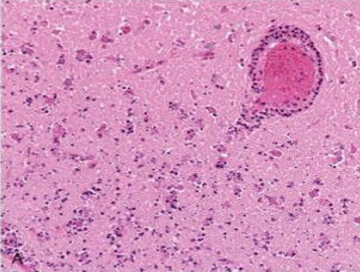
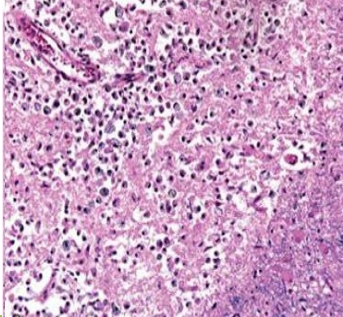
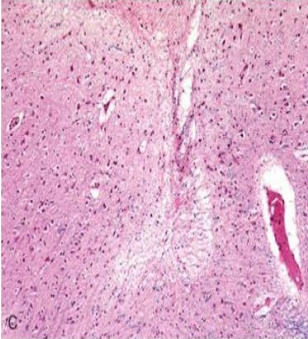
Gross pathology:

- 1-The brain is swollen, with wide gyri and narrowed sulci
- 2-The cut surface shows poor demarcation between gray and white matter



Histopathologic changes that attend irreversible ischemia injury (infraction) are grouped into three categories: **very important**

	Early stage	Subacute changes	Repair
Time	12-24 hr after the insult	24 hr – 2 weeks	Seen after 2 weeks
Changes	<p>Acute neuronal cell change (red neurons) characterized initially by microvaculation , followed by cytoplasmic eosinophilia, and later nuclear pyknosis (a degenerative state of the cell nucleus) and karyorrhexis (destructive fragmentation of the nucleus)</p> <p>Same happened in astrocyte and oligodendroglia after this, reaction to tissue damage begins with infiltration by neutrophils.</p>	<p>Necrosis of tissue influx of macrophages vascular proliferation and reactive gliosis</p>	<p>Removal of all necrosis tissue loss of organized CNS structure and gliosis</p> <p>In cerebral cortex the neuronal loss and gliosis produce an uneven destruction of the neocortex (Latin for "new bark" or "new rind")</p> <p>With preservation of some layers and involvement of others a pattern called "pseudolaminar necrosis"</p>

<p>Pictures</p>	 <p>red neurons (shrunken of cell bodies along with their nuclei)</p> 	 <p>after 10 days area infiltrated with macrophages and surrounding gliosis</p>	
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Take home messages:

- Stroke is the clinical term for a disease with acute onset of a neurologic deficit as the result of vascular lesions, either hemorrhage or loss of blood supply.
- Cerebral infarction follows loss of blood supply and can be widespread, focal or affect regions with the least robust vascular supply ("watershed" infarcts).
- Focal cerebral infarcts are most commonly embolic; if there is subsequent fragmentation of an embolism, a non-hemorrhagic infarct can become hemorrhagic.

Questions :

Which one of these cells more sensitive to ischemia :

- 1- Neurons
- 2- Astrocyte
- 3- Oligodendrocyte
- 4- Ependyma

Under microscope we noticed that there are pyknosis and karyorrhexis and the diagnosis was focal cerebral ischemia ,in which stage you may see these features :

- 1- Repair
- 2- Subacute
- 3- Early stage
- 4- Gliosis

Most of the people who die suddenly due to acute myocardial infarction are

- 1- Old people
- 2- Young people
- 3- Any age

Answers

1,3,2

Explanation of last question :

Because elderly have a time to make collateral vessels , that what our doctor said